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A REGIONAL WATER POLLUTION PROFILE

Federal Water Pollution Control Administration
Portland, Oregon

September 1968

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REGIONAL WATER POLLUTION

PROFILE

FWPCA Northwest Region

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Department of the Interior
Federal Water Pollution Control Administration
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CONTENTS

PART 1 BASIN PROFILE: COLUMBIA - NORTH PACIFIC

SUBJECT	Page	EXHIBIT	Page
SUMMARY OF POLLUTION PROBLEMS	1	SUMMARY OF PROBLEMS (TABLE)	2
Description		Location of Problems (Map)	3
1. Geography	4	Major Physical Features (Map)	6
2. Population	7		
3. Industries	8	Major Economic Features (Map)	9
Principal Water Uses			
1. Withdrawal Uses	11	Comparative Water Withdrawal	12
2. In-stream Uses	14	(Table)	
Water Pollution in Northwest	18	Use of Major Waterbodies (Table)	15
		Kinds and Sources of Pollution	29
Water Uses Impaired	31	(Table	
Cost of Pollution Control	36	Application of Implementation Plans to Pollution Sources (Table)	30
Institutional Framework	42		
1. State Programs	42	Water Uses Impaired (Table)	35
2. Institutional Barriers	45		
3. Enforcement Actions	47	Cost of Procedures (Table)	37
		Institutional Characteristics (Table)	43

PART 3 SUMMARY OF FWPCA PROJECTS AND RESOURCES

		Page
I.	Resources	50
II.	Organizational Structure	51
III.	Key Projects	52
	A. Water Quality Standards	52
	B. Basin Planning	52
	C. Technical Projects	55
	D. Federal Facilities Coordination	57
	E. Enforcement	57
	F. Construction Grants	57
	G. Pollution Surveillance	57
	H. Research and Development	58
IV.	Regional Problems of FWPCA	58
	A. "No Degradation" Policy	58
	B. Water Management Policy	59
	C. Enforcement and Compliance	59
	D. Thermal Pollution Policy	59
	E. Administrative	59
V.	Personnel	60

PART 2 BASIN PROFILE: ALASKA (Not Prepared)

Basin Profile, Columbia - North Pacific Watersheds
(FWPCA Northwest Region)

Summary of Pollution Problems

Water pollution, in greater or lesser degree, exists in every major Pacific Northwest river except the Kootenai. The Willamette and the Snake Rivers have suffered most seriously from water quality damages; but the Clark Fork/Pend d'Orreile, Spokane, Yakima, Boise, Portneuf, Walla Walla, Columbia, Tualatin, Santiam and other rivers have demonstrated severe problems. Puget Sound and the Grays Harbor and Coos Bay estuariane areas have also suffered water quality degradation.

Damages have been incurred principally by fishery and aesthetic uses of water; though fishery damages only represent the ultimate stage of general deterioration of the aquatic ecology, and aesthetic damages are symptomatic of conditions that restrict utility or increase the cost of irrigation, water supplies, and recreation.

Major sources of pollution are reservoir management procedures, agriculture, and factory wastes, though municipal wastes contribute to pollution in many circumstances.

Water quality problems include sediments and sludges, low dissolved oxygen levels, high bacterial concentrations, high water temperature, turbidity, oil slicks, and--increasingly prevalent--excessive enrichment of waters. Toxic concentrations of heavy metals occur below some mining areas; and toxicity has been suspected in connection with some manufacturing wastes and runoff of agricultural chemicals.

POLLUTION PROBLEMS OF THE NORTHWEST REGION

Location	Problem	Uses Impaired	Major Source	Fed'l Enforcement	Status
1. Puget Sound					
A (Port Angeles)	Sludges, Low DO, Toxicants	Aquatic Life, Recreation, Aesthetics	Pulp Mill Wastes	Yes	Conference Continuing, mutual Abatement measures agreed
B (Seattle Tacoma	Eutrophication, Low DO, Low pH, Discoloration	Recreation, Aquatic Life, Aesthetics	Municipal Waste, Aircraft Plant Wastes, Pulp Mill Wastes, Urban Runoff	No	Metro system adopted, collection, transportation and treatment procedures advancing improving rapidly
C (Lower Bellingham)	Sludges, Low DO Toxicants	Aquatic Life, Aesthetics	Pulp Mill Wastes	Yes	Conference continuing, mutual abatement measures under way
2. Willamette					
A (Portland Harbor	Low DO, Slimes, Bacteria	Aquatic Life, Water Supply, Recreation Aesthetics	Pulp Mill Wastes, Severson Mgt., Natural Flooding	No	Permit conditions require stringent controls, Municipal sewage collected, improving
B (Tualatin R.)	Slimes, Temperature, Pacteria, Low DO	Aquatic Life, Recreation Aesthetics,	Municipal Waste Low Depletion	No	High treatment requirements have been an adequate situation deteriorating
C (Santiam R.)	Low DO, Slimes	Aquatic Life, Aesthetics, Aquatic Life Aesthetics, Aquatic Life, Recreation	Pulp Mill Waste	No	Permit conditions require stringent control
D (West Side Tributaries)	Slimes, Temperature, Bacteria, Low DO	Recreation Commercial Fishing	Flow Depletion	No	No improvement indicated
3. Lower Columbia	Slimes	Irrigation, Aquatic Life, Recreation Aesthetics	Pulp Mill Waste	Yes	Conference continuing, second level abatement measures underway - no improvement on situation
4. Upper Columbia					
A (Walla Walla R.)	Low DO, Slimes, Turbidity	Aquatic Life, Recreation Aesthetics	Cannery Wastes, Flow Depletion, Agriculture	No	No improvement indicated
B (Yakima R.)	Low DO, Slimes, Temperature	Aquatic Life, Recreation Aesthetics, Water Supply, Recreation Aes	Irrigation Returns, Flow Depletion	No	No improvement indicated
C (Spokane R.)	Low DO, Sludges, Slimes		Municipal Wastes, Pulp Mill Wastes, Pasting	No	State requiring treatment improvements
D (Coeur d'Alene R. Kellog Wallace)	Sediments, Turbidity pH, DO, Toxics		Mining and Smelter Wastes	No	Regional Authority formed, industry will not treat until municipal treatment is complete
E (McNary Pool)	Temperature Radioactivity	Aquatic Life (Potential)	Nuclear Reactors	No	Under study - damages are considered petty but not current
5. Clark Fork (Burke)	Sediments, Turbidity, pH, DO, Toxics	All	Mining and Refining Wastes	No	Upper River is complex as stream treatment system, pollution reduced
6. Snake					
A (Portneuf R.)	Sediments, Turbidity, pH, Slimes, Temperature	Aesthetics, Downstream Irrigation	Chemical Wastes	No	Treatment being upgraded, situation improving
B (American Falls Reservoir)	Turbidity, Slimes	Irrigation, Aquatic Life, Recreation Aesthetics, Aquatic Life, Recreation, Irrigation	Agriculture, Municipal Wastes, Chemical Wastes,	No	No improvement indicated
C (Milner Reservoir)	Low DO	Aquatic Life, Aesthetics, Water Supply	Reservoir Management, Food Processing Wastes	No	Waste treatment being upgraded - no improvement indicated without reservoir management changes
D (Snake R.)	Low DO, Sludges, Slimes, Temperature, Bacteria	Aquatic Life, Recreation, Aesthetics,	Reservoir Mgt., Food Processing Wastes, Farm Animals, Irrigation	No	Waste treatment upgraded - situation improving
E (Brownlee Reservoir)	Slimes, Low DO	Aquatic Life, Recreation, Aesthetics	Reservoir Conditions	No	No improvement indicated
7. Oregon Coast					
A (Coos Bay)	Low DO, Bacteria, Debris, Sludges	Shellfish, Fishery, Aesthetics	Pulp Mill Wastes, Forest Products, Plant Wastes, Fish Processing Wastes	No	No immediate improvement indicated
B (Umpqua R.)	Temperature, Low DO, Slimes, Sediment	Aquatic Life, Recreation, Aesthetics	Water Management, Dredging, Mining, Salt Wastes,	No	No improvement indicated
8. Washington Coast					
A (Grays Harbor)	Sludges, Low DO, Toxicants,	Aquatic Life, Aesthetics,	Pulp Mill Wastes, Dredging,	No	Waste treatment being upgraded. Situation improving
B (Columbia R.)	Low DO, Slimes, Bacteria	Aquatic Life, Recreation	Municipal and Food Processing	No	No improvement indicated, situation may

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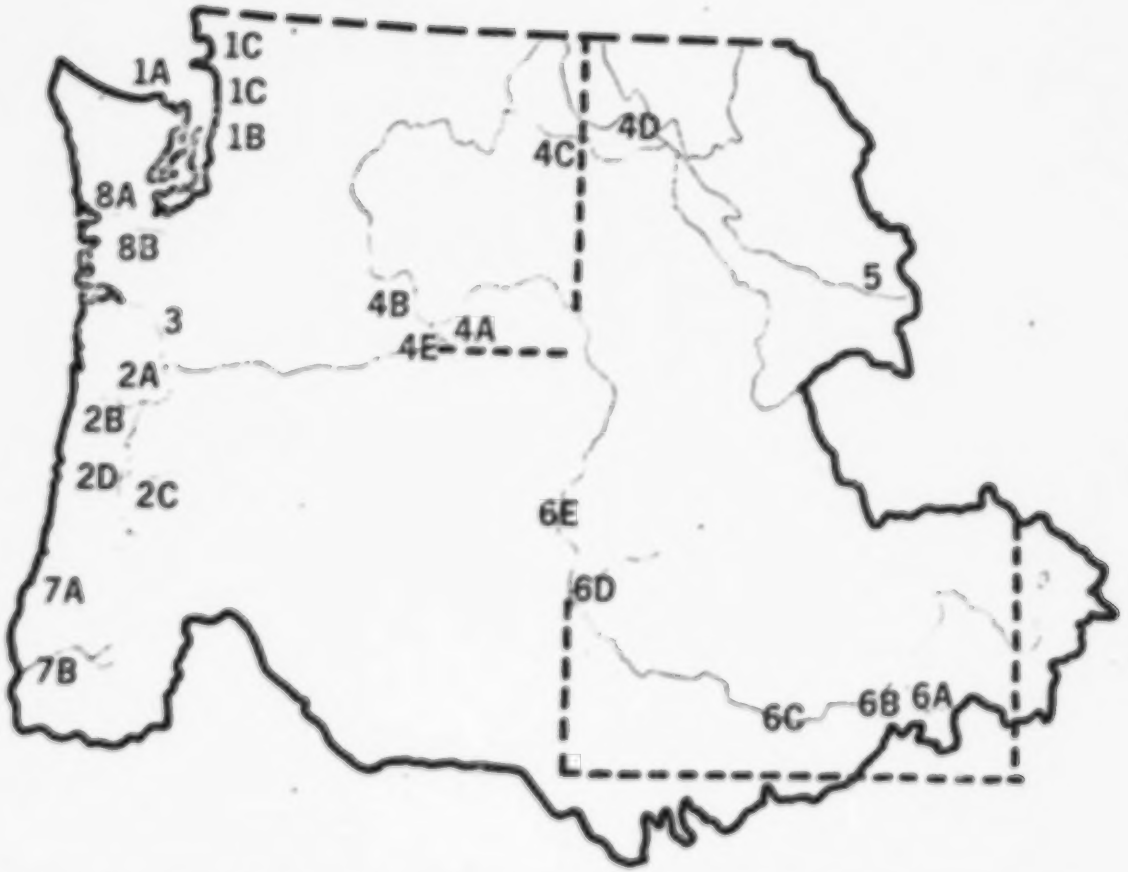


NORTHWEST REGION - LOCATION OF MAJOR POLLUTION PROBLEMS

I. Description of the Basin

1. Geography

The Pacific Northwest includes two major watershed areas. The greater part of the area is drained by the Columbia River system, which discharges an average annual volume of 180 million acre-feet a year. The thin coastal strip on the west slopes of the Coast Range and the northern Cascade Range develops another 50 million acre-feet or more, which flows directly into the Pacific Ocean or into Puget Sound.

The Columbia Basin includes four tributary systems which would constitute major watersheds in a less monumental framework. The Willamette, Clark Fork-Pend d'Oreille, and Kootenai Rivers each develops a runoff of over 25 million acre-feet a year, and the Snake produces 35 million acre-feet a year.

Six basic sets of landforms distinguish the area. On the west, the Coast Range of mountains descends sharply to the Pacific. An extended valley, the Willamette-Puget Trough, lies between the Coast Range and the much higher Cascades--the northern extension of California's Sierra Nevada. The area between the western slopes of the Cascade Range and the Pacific Ocean is a fertile rain forest where annual precipitation varies between 60 inches per year in the Willamette-Puget Trough and 150 inches a year at the tip of Washington's Olympic Penninsula. East of the Cascades, the Columbia Plateau, a semi-arid, elevated plain, takes up about a third of the total land

area of the region. These high flatlands give way to a series of successively higher, interfolded mountain ranges on the east--largest are the Wallowa, Salmon, Bitterroot, Clearwater and Rocky Mountains--that occupy another third of the region. The Valley of the Snake River, a fertile crescent curving between high northern mountains and the Bear Range on the south, constitutes the sixth identifiable sub-region of the Pacific Northwest. Most of the land area east of the Cascade Range is arid or semi-arid, depending on winter snowfall rather than rain for its water supply. Climate is generally moderate, growing more severe from west to east. Except for mountainous areas, the growing season through most of the Northwest is 150 days per year or more.

NORTHWEST REGION - MAJOR PHYSICAL FEATURES

2. Population

The Pacific Northwest is thinly populated. In an area about the same as the combined Ohio and Great Lakes watersheds, it musters a population of little more than 5.5 million persons. Of that total, well over three million are concentrated in the Willamette-Puget Trough, where the Portland and Seattle-Tacoma metropolitan areas lie. Oregon's Willamette Valley contains a million and a half persons. Another 1.7 million are located in the urbanized strip between the Cascades and Puget Sound that includes Seattle, Tacoma, Olympia, Everett and a substantial interstitial population. East of the Cascades, population is sparse. About a quarter of a million persons live in the Spokane metropolitan area, half a million are scattered along the snake Plain, and another two hundred thousand or so lie within a fifty mile radius of the juncture of the Snake and Columbia Rivers.

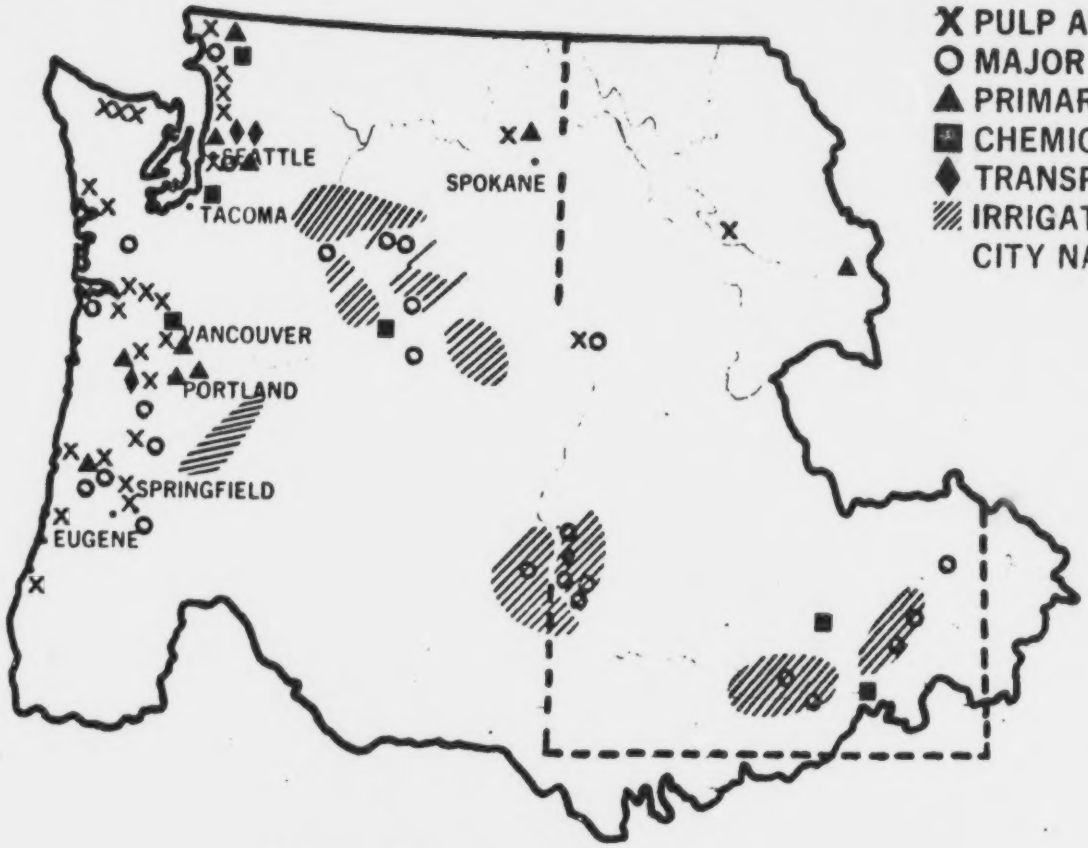
Historically, population growth in the area has occurred at rates well over those of the nation as a whole. During the nineteen-fifties, however, the rate of population growth dipped to little more than the natural rate of increase. While future growth of population may be expected to occur at rates modestly higher than the nation's, there is little reason to anticipate revival of the vigorous growth of the past. The region seems to have reached relative maturity since World War II.

3. Industries

Natural resources have dictated the pattern of industrial development of the Pacific Northwest. Forest and agricultural products dominate the region's economic patterns. The area produces forty percent of the nation's lumber, most of its plywood and hardboard, a quarter of its wood pulp, twenty percent of its paper, half of its apples, half of its potatoes, a quarter of its beet sugar, sixty percent of its peas, a quarter of its green beans, an eighth of its beef, most of its soft wheat.

Industrial development in the last two decades has built in large measure on these basic, long-established industries. The thousand or more individual sawmills have shrunk to a couple of hundred, but their production capacity is greater than before, and they share their markets with almost fifty plywood mills, a couple of dozen hardboard mills. Basic pulping capacity has been increased through plant expansion and construction of eight new pulp mills since World War II; and the Northwest--long a pulp exporting area--now uses most of its pulp in the production of paper. Similarly, while agricultural output has been expanding, growth of food processing has gone on at an even greater rate; so that the major portion of the area's output of agricultural products is now processed in the Northwest.

More rapid development has occured in newer industrial lines. Availbility of almost a third of the nation's hydroelectric capacity within the region has created a concentration of electroprocess industries. Aluminum plants date to the early nineteen-forties; and



X PULP AND PAPER
O MAJOR FOOD PROCESSING SITE
▲ PRIMARY METALS
■ CHEMICAL AND OIL REFINING
♦ TRANSPORTATION EQUIPMENT
▨ IRRIGATED AGRICULTURE
CITY NAME=POPULATION CENTER

NORTHWEST REGION MAJOR ECONOMIC FEATURES

aluminum output--currently accounting for over a third of the nation's supply--continues to expand. The region also provides much of the nation's titanium--a result of cheap electric power and technical developments originating from the Bureau of Mines Albany, Oregon laboratory. Phosphate products are manufactured in eastern Idaho, cooper in western Montana, coal in western Washington, lead and zinc in northern Idaho, electro-chemicals along the lower Columbia River, plutonium at Hanford on the Columbia, aircraft in Seattle, ships and highway and rail rolling stock in Seattle and Portland.

Water is a critical raw material to much of the Northwest's industry. Without irrigation and cheap hydropower, the larger share of the region's postwar development would not have occurred.

II. Principal Water Uses

1. Withdrawal uses

Abundant water supplies lead to prodigal use of water in manufacturing, agriculture, and personal use. Westgarth (Municipal Water Needs in the Pacific Northwest) has defined average per-capita use in the region as 187 gallons per capita per day. Eichberger (Industrial Water Use) traces a pattern of higher water inputs per unit of labor input or per dollar of values added by manufacture than in any other part of the nation. Average irrigation diversions, though marked by distinct sub-regional variations, exceed 4.5 acre-feet per acre, about 50 percent above the western average. Water is so plentiful that there has been little effort on a total regional basis to conserve it or to limit use.

Among the various withdrawal uses of water, irrigation far outstrips the combination of all others. The great irrigation developments of the Snake River Plain and of the Columbia Plateau account for most of the irrigation demand; but supplemental irrigation is becoming increasingly prevalent in the humid areas west of the Cascades, and individual or corporate irrigation projects along the Columbia, the Snake, and their tributaries continue to expand the extent of irrigation.

Industrial use of water is slightly greater than municipal and other domestic use. Almost three-fourths of the total industrial demand for water orginates in the pulp and paper industry, where a concentration of old sulfite pulping plants results in an unusually

TABLE 2

COMPARATIVE WATER WITHDRAWAL

Source of Demand	Withdrawal, in billion gallons per year	Percent of total
Municipalities (over 2500 population)	241	3.1
Other Domestic Supplies	139	1.8
Industrial	483	6.2
primary metals	29	0.4
chemicals	36	0.5
food processing	18	0.2
pulp & paper	322	4.1
other forest pdts.	70	0.9
all other mfg.	8	0.1
all industrial cooling	139	1.8
Irrigation	6,886	88.1
Stock-watering	65	0.8
Total	7,814	100.0

high unit application of water. A peculiarity of the region is that a small portion of industrial water use is for cooling. Less than 30 percent of recorded water use by manufacturers is for cooling; and the only significant block of thermal-electric power production is the 85 megawatt Hanford, Washington plant. (The situation will be changing rapidly, however. Over 7000 megawatts of thermal power capacity are projected to be required over the next decade. The Northwest's era of hydropower development has ended, with virtually every feasible site now preempted).

2. In-stream Uses

The economic and social significance of water to the Pacific Northwest extends far beyond that provided by uses of water that require it to be diverted from watercourses. Quantification is impossible, but it would seem that the uses of water that occur within natural channels are as important to the area as are withdrawal uses.

Navigation underpins the economies of the two major metropolitan areas of the Northwest. Both Portland and Seattle developed as Seaports and--Portland particularly--have continuously expanded as focci of transportation and service networks based largely on port facilities. In Portland's case, sea-going navigation is supplemented and complemented by vigorous barge traffic on the Willamette and Columbia Rivers.

Hydroelectric power, based on the huge flows of the Columbia system and the great head it develops in its fall from the Rockies to the Pacific, has been the basic energy source of the Northwest for a quarter of a century. Availability of low cost hydro-power has shaped the industrial development of the region, and has caused it to develop great competence in regional planning based on large blocks of electric power, long distance transmission of power, interlocking grids, and other techniques of energy utilization that are becoming standard American technology.

Fisheries have assumed great commercial and social values in the life patterns of the Northwest. Commercial fisheries serving national and international markets have been in existence for a century, with

TABLE 3

WATER USE MAJOR NORTHWEST WATER BODIES

WATERBODY	MUNICIPAL SUPPLY	INDUSTRIAL SUPPLY	RECREATION	NAVIGATION & BOATING	AESTHETICS	STOCK WATERING	IRRIGATION	HYDROPOWER	FISH AND AQUATIC LIFE	WATERFOWL	ASSIMILATION
Puget Sound		X	X	X	X				X	X	X
Snohomish R.	X	X	X		X	X			X	X	X
Duwamish R.	X	X	X		X				X	X	X
Greys Harbor			X	X	X				X	X	X
Lower Columbia R.		X	X	X	X	X	X	X	X	X	X
Willamette R.		X	X	X	X	X	X	X	X	X	X
Tualatin R.			X		X	X	X		X		X
Santiam R.	X	X	X	X	X		X	X	X		X
McKenzie R.	X		X	X	X	X		X	X		
Clackamas R.	X		X	X	X			X	X	X	
Cowlitz R.	X	X	X	X	X	X		X	X		X
Deschutes R.			X		X	X	X	X	X	X	
Upper Columbia R.		X	X	X	X	X	X	X	X	X	X
Snake R.		X	X	X	X	X	X	X	X	X	X
Boise R.	X	X	X	X	X	X	X	X	X	X	X
Salmon R.	X	X	X		X	X			X		
Payette R.			X		X	X	X		X	X	X
Clearwater R.	X	X	X	X	X				X		
Portneuf R.			X		X	X	X		X	X	X
Henrys Fork		X	X	X	X	X	X	X	X	X	X
Grande Ronde		X	X	X	X	X	X		X	X	X
Clark Fork	X	X	X	X	X	X	X	X	X	X	X
Lake Pend d'Oreille	X		X	X	X				X	X	X
Pend d'Oreille R.		X	X		X				X	X	X
Kootenai R.	X		X		X				X		
Spokane			X			X			X	X	X
Yakima R.		X	X	X	X	X	X	X	X	X	X
Walla Walla R.	X			X		X	X		X	X	X

[ ] = Use Limited by Pollution
X = Use Occurs

crabs and salmon produced in great quantities, oysters and clams in lesser amounts. Recreational fishing is widespread, with angler emphasis devoted to salmonids--salmon and trout.

The people of the Pacific Northwest have an extreme regard for their salmon. The great migratory fish of the Pacific once spawned throughout the Columbia system, and in almost every coastal stream. Now dams have reduced the effective spawning area of the Columbia to less than half its former extent. No salmon can pass above Grand Coulee on the Columbia, Brownlee on the Snake, Lookout Point and Cottage Grove on the Forks of the Willamette, Pelton on the Deschutes. And it is the threat of further reduction of the resource that spearheads anti-pollution activities in the Pacific Northwest.

Water-based recreation is another accepted feature of life in the Pacific Northwest. Oregon has more State parks than any other State in the Nation, almost all of them based on water. Recorded per-capita visits to State parks in the Pacific Northwest exceed those of any other region in the Nation, in spite of competing private and Federal facilities and the low population density of the area. In Idaho, one person in four purchases a fishing license, in Washington one person in six, in Oregon one person in five--the national average is one in ten. Per-capita boat registrations in Washington lead any other State in the Nation; and Oregon is close behind.

Aesthetic appreciation of water is closely allied with intensity of recreation. The coast lines of Oregon and Washington are public properties; and citizens jealously guard against private encroachment on their rights of access. River fronts and lake shores are preferred home sites, where not developed for industry or recreation. Population of the region stretches out along its major waterways, with population density thinning rapidly as distance to rivers increases. An extensive highway system parallels, and utilizes the scenic advantages of, rivers and other waterways. Access to water, in both its physical and aesthetic functions, is part of the heritage of the area. Water rights laws of region guard that access; and disputes to preserve it are not infrequently resolved at the point of a gun, even in the seventh decade of the twentieth century.

III. Water Pollution in Northwest

Pollution of the waters of the Pacific Northwest assumes every form of water quality problem, with the exception of salinity.

Dissolved oxygen deficiencies, the traditional pollution benchmark of the sanitary engineer, occur in some degree in the Snake River and in several of its tributaries, in the Walla Walla and Spokane Rivers of the upper Columbia drainage, in the Willamette River and some of its tributaries. Pulp and paper wastes and wastes of food processing that occur in conjunction with low flows--in large measure the result of reservoir management procedures that are not geared to water quality needs--are the principal sources of serious dissolved oxygen drawdown. Municipal wastes contribute to biochemical oxygen demand that results in oxygen drawdown; but in every case except that of the Tualatin River--part of whose watershed is a densely populated suburban area of Portland, Oregon--the effects of municipal wastes are slight, relative to those of industrial wastes and water management.

Water quality standards of the four Northwest States are uniformly high with respect to dissolved oxygen--a reflection of the importance of salmonid fish to the area. In general, Washington's standards require that minimum dissolved oxygen concentrations for rivers of strong, constant flow (the Columbia River, the Snake River, coastal streams) be 8 Mg/l; lesser streams (mainly east of the Cascades) be at least 6.5 Mg/l; and marine waters be at a minimum of 5 or 6 Mg/l, depending on conditions. Montana, in effect, requires a minimum of 7 Mg/l in all

waters of the Columbia system other than industrial-classified Silverbow Creek. Oregon's general standards forbid a dissolved oxygen concentration that falls below 6 Mg/l as a result of a waste discharge (with some exceptions for natural conditions) and require that dissolved oxygen be at least 95% of saturation in salmonid spawning areas during the period of spawning and hatching. Idaho requires at least 75% of saturation during seasonal lows, and 100% of saturation for fish spawning areas in season.

All four States have filed detailed implementation plans, which are apparently adequate to deal with conventional point waste source of oxygen problems. Secondary waste treatment or its equivalent is a general requirement--and in Oregon and Washington it is one that can be enforced through a tight system of permits. Collateral sewering requirements are generally spelled out in some detail. Washington has considered non-waste sources of oxygen-demanding organics or of interference with aeration; though such matters are dealt with only by indicating a need for study. And Idaho has made its dissolved oxygen standard for a critical reach of the Snake River conditional on flow.

Turbidity--other than the natural turbidity caused by high water, snowmelt, wind, and bank caving--is most marked in the heavily agricultural Snake River and Walla Walla River and in the upper reaches of the Clark Fork. Erosion of cropland, crude irrigation practices, and mining are the principal sources. Industrial wastes--pulp and paper manufacture in Puget Sound and the Willamette River, lumbering and logging in forested areas, phosphates manufacture on the Portneuf River, food processing throughoout the Northwest, aircraft manufacture on the lower Duwamish River, and

mining and smelting on the Clark Fork and Pend d'Oreille--all have discernible impacts on the clarity of water, at least in the area near outfalls.

For the most part, water quality standards for turbidity are broadly hedged. Washington has set a limit of 5 JTU for class AA ("extraordinary") waters. But beyond this clear cut standard, things become less certain. Washington, Montana--and in some special standards, Oregon--call for no more than 5 or 10 (depending on the stream classification) JTU above "natural" turbidity. Natural turbidity, however, is not defined. Oregon's general standards and Idaho's standards are even more obscure. Oregon forbids any waste discharge that produces "objectional discoloration [or] turbidity...." but without defining either "waste discharge" or "objectionable." Idaho does not allow "objectionable turbidity which can be traced to a point source."

Implementation plans do not, in practical terms, exist. Idaho specifically excludes remedies for turbidity due to agricultural waste or drainage, until future studies of their effects are completed. Oregon calls for undefined "cooperative programs" to reduce erosion, and intends to study agricultural wastes. Montana requires that highway and local government projects be cleared with its Fish and Game Commission to reduce turbidity and sedimentation effects, falls back upon the study device to deal with agricultural drainage. Washington will undertake studies of soil erosion, agricultural wastewater, log storage, and dredging practices and has indicated that initiation of control procedures will be deferred until the studies are completed. All four States have active programs of sewer

seperation, but indicate no mechanism for dealing with broader problems of urban runoff.

Sludges or sediments occur in all of the areas marked by excess turbidity, with the exception of the swift-flowing Pend d'Oreille. Settling of the suspended materials responsibile for turbidity creates the sediment beds.

Water Quality Standards for sediment deposits are somewhat less vague than those for turbidity. Idaho's standards allow no "visible...sludge deposits...deleterious to...aquatic life or injurious to public health, recreation or industry." Montana, in substance, permits no sediment deposits other than those arising from natural sources. (As always, "natural sources" are not defined.) Washington presents only a catch-all prohibition against offensive substances.

There are no programs proposed to deal with sediments other than those caused by point waste discharges. The lack of methods to deal with turbidity obviously precludes means of dealing with settleable substances that result in turbidity.

Enrichment of waters by growth-producing nutrients is probably the most prevalent--and the most obviously increasing--source of pollution in the Northwest. The condition applies with greatest force in mid-Columbia lakes and the Snake River, but is present in the Spokane, Yakima, Walla Walla, lower Columbia, Chehalis and lower Willamette Rivers to the point that growths constitute a nuisance; and it is observable in many other streams in lesser degree. Release of nutrients occurs with stabilization of any organic waste; so, to some extent, the increase

in nutrient levels in the waters of the Northwest may be traced simply to constantly higher populations and manufacturing outputs. Over and above the increased scale of materials discharge, however, distinct source of pollutional enrichment may be identified. 1) secondary treatment of municipal wastes is well advanced in the Pacific Northwest. Discharge of dissolved mineral products of the treatment process accelerates biotic uptake, triggering more immediate and more massive aquatic growths than would occur with in-stream decompostion of wastes. 2) Extensive phosphate deposits in the Snake River watershed are carried to waterbodies by natural drainage. 3) Wastes of phosphate processing plants near the Snake River cause an enormous increase in downstream phophorus concentrations, though this is being corrected by treatment. 4) Slime growths are believed to adhere to, and feed upon, wood particles. These are abundantly present in water in lumbering area--more particularly below pulp and paper plants and below the waste discharge points of timber processors that employ hydraulic barking equipment. 5) As in the rest of the Nation, use of phosphorous-based detergents has resulted in marked increase in nutrient concentrations of domestic wastes.

Water quality standards of the States of the Northwest reflect fully the prevailing uncertainty as to sources of enrichment and the lack of a developed control technology. Washington, oddly enough, is more specific with respect to control of enrichment of law classification waters (Class C) than for higher classified waters. For Class C waters, the State postulates that "aesthetic values shall not be interfered with by... slime or aquatic growths...", while AA and A waters must adhere to a

standard that requires that "aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of [undefined] natural origin, which offend the senses...." Montana has no standards regarding nutrients or their effects, except insofar as these may be covered by turbidity and color requirements. Oregon, characteristically limiting the scope of its responsibilities, forbids waste discharges causing fungi or other deleterious growths. Idaho, almost as vague as Washington, requires that "waters shall not contain excess nutrients of other than natural origin," defining neither "excess" nor "natural origin."

With respect to control procedures, both Idaho and Oregon require definite--if limited--abatement measures in their implementation plans. Idaho has defined treatment and process measures to limit phosphorus concentrations of wastewaters from two chemical plants. Oregon is requiring nutrient removal for all wastewaters--largely of municipal origin --discharged by sewers in the Tualatin River's watershed. Neither Washington nor Montana details any responsibilities for controlling discharge of nutrients.

Bacterial concentrations are well above established standards below almost every population center and in areas marked by large numbers of cattle. The prevalence of industries charactized by large discharges of organic materials contibutes to maintenance of bacterial populations by supplying them with nutrients, thus stimulating regrowth and slowing the rate of die-off.

Water quality standards of all four Northwest States generally require that bacterial levels be under 1000 MPN. In some waters with high current bacterial quality more stringent --50, 70, or 240 MPN-- limitations are applied. Each.State invokes a very reasonable escape clause: The Standard applies where the coliform are associated with fecal sources.

Implementation plans call for general disinfection of municipal waste discharges, and contain statements of intention to pursue policies intended to prevent sewer overflows. There is, then, substantial indicated effort to limit point discharges of fecal coliform sources. With reference to other sources of water-borne bacteria, the only indication of an active control effort is Idaho's intention to negotiate procedures for feed lot controls.

Toxics are known or suspected to occur in water as a result of a number of industrial waste discharges. In many instances, the toxicity occurs because of a marked increase in acidity--a decline in pH levels. In others, heavy metals are at fault. Fabrication of exotic metals at Albany, Oregon on the Willamette River, discharge of plating and clean-up wastes to the Duwamish River from a Seattle aircraft manufacturer, discharge of strong bleaching wastes from pulp and paper mills on the lower Columbia, the Willamette, in Grays Harbor, and on Puget Sound are known to be toxic; highly acid wastes of phosphate plants on the Portneuf River, heavy metals from cooper mines and mills at Butte, Montana and from smelters and mines in the Kellog-Wallace area of Idaho have all been associated with toxicity to aquatic life. It is strongly suspected, too, that pesticide residues in agricultural areas--particularly in the Snake River watershed where such phenomene has been documented--result

in at least intermittent poisoning of aquatic life. Pesticide residues have also been detected in ground waters at many places in the Columbia Basin irrigation project. Biologists in the region have long suspected that there are synergistic toxic effects from the sulfides and mercaptans discharged as constituents of Kraft pulp mill wastes. Adequate laboratory demonstration of such toxic effects have occured; but they have proved impossible to corroborate in the stream.

Standards for toxicity vary widely in expression among Northwestern States. Idaho, most specific, allows no more than 0.5 induced variation in pH, expresses radioactivity standards both in terms of maximum controls and PHS drinking water standards, and provides a general statement forbidding toxic materials of other than natural origin. Oregon has established maximum permissable concentrations of a broad range of materials--all well within the drinking water standard--for specific waterbodies. Montana's requirement is substantially that concentrations of toxic materials shall not exceed 40% of the TLm for aquatic biota and shall be within the drinking water standard. Washington's toxicity standard is quite loose, ranging from "toxics... concentrations shall be less than those which may affect public health, the natural aquatic environment, or the desirability of the water for any usage" in the case of AA waters, down to a prohibition against toxic interference during the course of a characteristic use, or concentrations that result in "acute or chronic toxic conditions to the aquatic biota;" while induced pH variations are limited to 0.1 units.

Implementation plans, while characteristically loose with respect to non-point sources of toxics (c.g. heavy metals or acid mine drainage, pesticide run-off), are quite precise with respect to potentially toxic industrial waste discharges. Oregon, in particular, has written very stringent permit conditions for that kind of wastes; and the other States have historically exerted great pressure for controls in instances of toxic wastes.

Heating of waters is a growing problem of the area, one that threatens to become critical with increased steam generation of electricity. At the present time cooling water discharges to the upper Columbia River from the Hanford nuclear installation are often noted to be a source of excess heat, particularly in combination with flow variations induced by upstream hydropower peaking operations. And with construction of Ben Franklin Dam on the Columbia, Hanford's discharges into the reservoir pool are expected to result in an extreme increase in temperature. Every large manufacturing plant contributes in some measure to temperature increases. More significant at this time are temperature modifications that occur as a result of increased exposure to solar radiation that occurs with ponding in the many reservoirs of the Pacific Northwest. These are most critical in areas of highly developed irrigation, since effects are magnified and transmitted downstream by water depletion and by surface irrigation return waters that have been warmed on fields. For this reason, the Yakima, Walla Walla, Tualatin, and Snake Rivers--all heavily used for irrigation--consistently exhibit extremely high summer temperatures.

Water temperature standards have become a source of significant policy dispute in the area, in that FWPCA has approved standards for Washington that are at variance with those approved for Oregon and Idaho. Oregon standards do not permit discharges causing a measureable increase above a stream temperature of 64^{0}, and allow an increase of up to 2^{0} when water temperature is at or below 62^{0}. Slightly higher temperatures are allowed by some special standards, notably those for the Columbia River, where a 2^{0} increase is allowed up to 66^{0}, with a maximum permissable temperature of 68^{0}. Idaho allows no increase when stream temperature is 68^{0} or higher, and up to a 2^{0} increase when water temperature is 66^{0} or less (A somewhat higher maximum temperature is provided for in the Brownlee Pool reach of the Snake.) Washington allows no temperature increase beyond 60^{0} in fresh water or 55^{0} in marine water--but cumulative temperature increases on a river are permitted on a ratio scale. Since maximum fresh water temperatures are set well below natural highs and are thus effectively meaningless, the cumulative permissable increases become critical. The formula has been interpreted to permit a 3^{0} to 5^{0} increase in the temperature of the Columbia. Montana's standards allow a 2^{0} temperature increase up to 67^{0} and a 0.5^{0} increase in temperature above 67^{0}.

There are no implementation plans with respect to temperature written into the water quality standards of any of the four States. Large scale proposed additions to thermal generating capacity make temperature a matter of imminent import to the region, and the Pacific Northwest Pollution Control council has produced a resolution calling for cooling systems for

any plant that is to be constructed. In the absence of Federal sanctions for temperature control measures, and in view of powerful pressures from regional development groups to limit application of temperature controls, the PNWPCC resolution has a hollow ring. (In this connection it should be noted that some of the strongest resistance to temperature contols has come from Federal Agencies--the Atomic Energy Commission and the Department of Interior's Bonneville Power Administration.)

Special pollutional problems of the area include oil spills and estuarian polltuion. Oil spills-- forbidden by all four States' water quality standards, and with responsiblity for enforcement invested in FWPCA--occur with fair regularity in the ports of Portland, Seattle, Tacoma, Anacortes, and other places where oil is discharged by tankers. An intermittent nuisance is also created on recreational beaches when oil from bilges pumped at sea is washed ashore. Federal law allows indiscrimate dumping by American Flag carriers beyond fifty miles; and there is a general presumption that even the modest fifty mile limit is often ignored.

Estuarian pollution is a matter of increasing concern. The delicate balance of the estuarian environment and its value as a nursery area for aquatic life are threatened by the attractiveness of estuaries for industrial and recreational development. In particular, dredge and fill operations and the persistence of organics and nutrients caused by the interaction of tide and flow represent distinct sources of concern to those concerned with maintenance of estuaries.

TABLE 4

KINDS AND SOURCES OF POLLUTION PROBLEMS NORTHWEST REGION

SOURCE OF PROBLEM		KIND OF PROBLEM								
		Oxygen dfcy.	Turbidity	Sediments	Enrichment	Bacteria	Toxics	pH	Heat	TDS
MUNICIPAL	Municipal Wastes	▨			▨	▥				
	Urban runoff									
MANUFACTURING	Primary metal		▨	▨			▥			
	Canning & Frzg.	▭	▨	▨	▨					
	Steam power								▨	
	Pulp & Paper	▭	▨	▭	▥		▨	▨	•	
	Lumber		▨	▨	▨		▨			
	Trsptn. Eqpt.		▥				▨	▨	▨	
	Chemicals		▥	▥	▭		▥	▨	▥	
AGRICULTURE	Irrigation		▭	▭	▨		▨		▭	
	Farm Animals		▨		▨	▭				
	Cropland erosion		▥	▥	▨					
	Pesticides						▨			
	Logging		▨	▨						
MINING	Heavy Metals						▥			
	Acid							▥		
	Solids		▭	▭						
OTHER	Spills & Vessels	▨	▥			▨				
	Natural Drainage		▭	▭	▥					
	Reservoir Mngt.	▭								
	Dredging		▥	▥						

▭ = heavy impairment: extended both in time and in area of effect

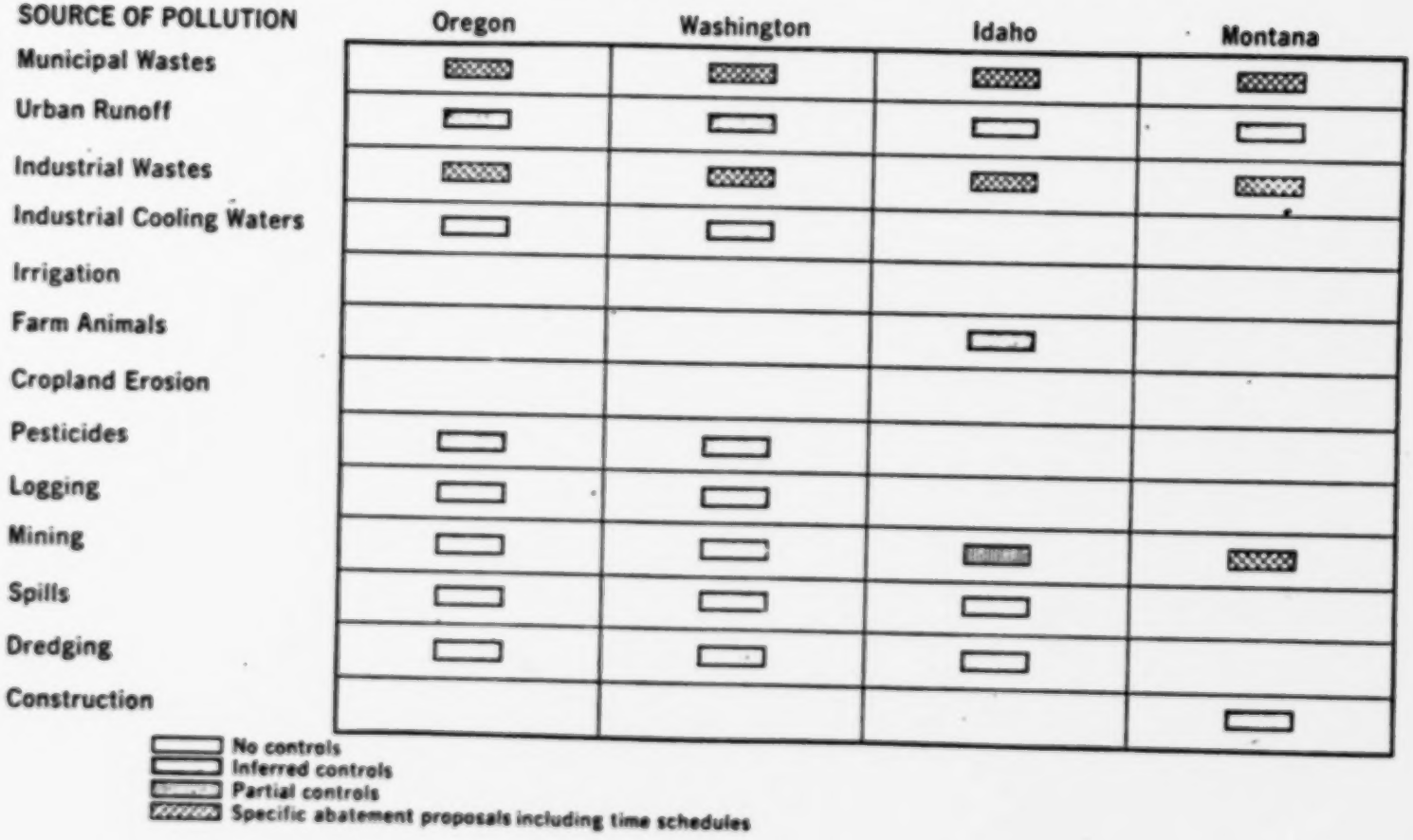
▥ = moderate impairment: limited in either time or area of effect

▨ = light impairment: limited both in time and in area, contributory to some larger source of problem, or the source of a potential problem

▭ = no control

TABLE 5

APPLICATION OF IMPLEMENTATION PLANS TO POLLUTION SOURCES NORTHWEST REGION



IV. Water Uses Impaired by Pollution

It is difficult to characterize any situation as constituting "pollution" if there is no impairment of utility. There are no standards for purity of water, only threshold levels that limit water's application to certain uses. It has been noted that there are eight sorts of water quality conditions in the Northwest--conditions created by nineteen generalized kinds of activities--that constitute pollution. It remains, then, to be seen how those conditions--low dissolved oxygen, turbidity, sediments, enrichment, bacteria, toxics, acidity, and heat--restrict or impair water use.

(It must be noted that the simplified discussion that follows can not adequately describe the way in which pollutional conditions reinforce and overlap upon one another. Damages to categories of use are indicated to be direct relationships between a condition and its consequence. In fact, however, conditions interact upon one another in almost symbiotic fashion. The clearest example is the fact that Northwest communities almost without exception do not use the cheapest and most readily available sources of municipal water supply. Major rivers--the Willamette, the Snake, the Columbia--flow unused through cities that turn to distant, protected watersheds or to groundwater for their supplies. It is not that these rivers are not suitable sources of water. Rather, there is a reluctance--essentially aesthetic and irrational, but very real--to use water supplies taken from rivers known, or believed, to be polluted. Distaste for use of appropriate water supplies, then, costs the residents of the area millions of dollars annually. Though the pollution-induced

impairment of a potential use is not direct or tangible, the costs it involves are very real).

Municipal and domestic water supplies have suffered from aquatic biota--which impart disagreeable tastes and odors and clog intakes--in the case of the cities of Twin Falls, Spokane, and several smaller communities. In almost every case, the community has developed a groundwater supply to replace its previous surface supply. Heavy metals concentrations limit use of portions of the Clark Fork/Pend d'Oreille for water supplies.

Industrial water supplies from surface sources are restricted by both turbidity and presence of aquatic biota in the upper Columbia River area and the Snake River area. In each instance industries generally prefer to incur the costs of well drilling and pumping rather than to use surface sources of water. And at Hanford, nuclear reactors that have since been abandoned were unable to draw cooling waters from below Grand Coulee Dam because they were too warm for effective cooling.

Irrigation, too, has encountered difficulties as a result of excessive aquatic productivity. In the Snake, Yakima, and Walla Walla River basins, buildup of vegetation in waters clogs pumps, headgates, canals, restricts carrying capacity of canals and storage capacity of reservoirs, even results in deposits on cultivated field that become thick enough to impede drainage and restrict plant growth.

Aquatic life forms suffer the major damages of pollution. Dissolved oxygen deficiencies in the Lower Willamette River, tributaries of the

upper Columbia River, and tributaries of the Snake River preclude--at least seasonally--the presence of salmonid fish. Sediments that smother spawning grounds have damaged populations of trout, salmon, oysters in Puget Sound, trout and salmon in the Willamette system, trout in the Snake system. Toxic industrial or mining discharges have had severe effects on aquatic ecology in Puget Sound, the Couer d'Alene River, the Clark Fork, and the Portneuf River. In the Snake River, pesticides are believed to have adversely affected fish and wildfowl population. High water temperatures have contributed to decreasing salmon runs in the Willamette, lower Snake and Columbia Rivers, and have entirely precluded natural reproduction of trout in a very large portion of the Snake River.

Recreational damages from pollution include the administrative definition of much of the Willamette River and the Columbia River below the mouth of the Willamette as unsafe for swimming, an unwillingness to use much of the Snake River for swimming due to the heavy aquatic weed growth, shrunken sport fishing opportunities, nuisance accumulation of aquatic growths on lines and nets in the Snake, Willamette, Columbia, and Yakima Rivers.

Aesthetic damages imposed by pollution include odors resulting from oxygen deficiency that occur seasonally in the Chehalis River, the Walla Walla River, the lower Boise River, the Palouse River, in several Snake River reservoirs, and, intermittently, in Portland Harbor. Sludge beds are common below many food processing and pulp and paper plants, as well as some other major manufacturing sites. Turdidity is a general consequence of careless irrigation practices in the Snake and Yakima Rivers, and a result of industrial wastes at many points.

Probably the most offensive aspect of pollution in the Northwest is the thick blankets of aquatic weeds that are abundant through most of the southern Snake River, the Yakima River, and the Walla Walla River.

TABLE 6

WATER USES IMPAIRED

Pollution Problem	Water Supply			In-stream use		
	Municipal	Industrial	Irrigation	Aquatic Life	Recreation	Aesthetics
Oxygen Deficiency				▥		▨
Turbidity		▨			▨	▥
Sediments				▥	▨	□
Excessive Biota	▨	▨	▥		▥	□
Bacteria					▥	
Toxics	▨			▥	▨	
Acidity				▨		
Heat				▥		
Oil				▨	▨	▨

□ = Heavy impairment
▥ = Moderate impairment
▨ = Light impairment

V. Costs of Water Pollution Control

It is not possible to be precise about the cost of pollution control until objectives, methods, and procedures for control are defined. There is an unmistakable tendency in the FWPCA to equate pollution control with waste treatment, which is no more than an element in a complex matrix of requirements. Given the present state of technology, some pollutional aspects of water use simply can not be controlled; in such cases we must either accept the probability of pollution or look to some trade-offs among water uses. It is painfully clear that if we are to define pollution control costs, we must tread into some very sticky areas of policy and technical uncertainty.

To avoid the necessity for making determinations in the areas of policy or technical alternatives, costs are presented in a very generalized way. Costs of total application of control procedures, within the limits of existing technology, have been calculated for each general category of pollution-inducing conditions--municipal wastes, industrial wastes, agricultural practices, and reservoir management procedures--and a judgement has been made about the effect on water quality to be anticipated from such control procedures. The major value of the exercise is that it is felt to provide a view of relative costs and consequences of a series of program possibilities.

Municipal waste treatment is assessed at the estimated capital amount, as presented in The Cost of Clean Water, required to provide complete secondary treatment to the municipal population of the region. Prevalence of secondary treatment of municipal wastes is currently very high

TABLE 7

COST* OF APPLYING ADDITIONAL POLLUTION CONTROL PROCEDURES

SOURCE OF PROBLEM	TECHNOLOGY AVAILABLE	TECHNOLOGY COSTLY OR INADEQUATE	ANTICIPATED IMPACT ON WATER QUALITY
MUNICIPAL WASTES,			
SECONDARY TREATMENT	$577.5		SLIGHT OR NEGATIVE
NUTRIENT REMOVAL		$ 40 - 85 P.A.	MODERATE
INDUSTRIAL WASTE			
BOD & SOLIDS RDCTN.	46.5		MODERATE
NUTRIENT REMOVAL		50 - 105 P.A.	MODERATE
AGRICULTURAL PRACTICES		4 - 9 P.A.	
EROSION CONTROL			MAJOR
ANIMAL WASTE CONTROL			SLIGHT
RESERVOIR MANAGEMENT	UNCERTAINTY		MAJOR
TOTAL CAPITAL COSTS (ANNUAL COSTS CAPITALIZED AT 6%)	624.0	1550 - 3300	

* Millions of dollars

in the region, and the indicated costs are, in large measure, those associated with increasing the degree of treatment of waste discharged to the Pacific Ocean and the Columbia River, or of providing sewering and waste treatment to communities currently using effective ground disposal methods. With the exception of the Walla Walla River, the Tualatin River, and--perhaps--the Spokane River, there are no cases in which municipal wastes contribute significantly to a stream's oxygen deficiency. (And secondary treatment is now provided in both the Tualatin and Walla Walla basins.) Because little meaningful advantage is to be anticipated from the extension of conventional waste treatment--and there may be actual diseconomies in the form of additional enrichment of water and the discharge to watercourses of residual organics now discharged to the ground--we may assume that the cost is that associated with procedures desirable from a policy viewpoint rather than costs of direct water quality improvements.

Nutrient removal costs are those associated with the operation of presently available techniques of phosphorus reduction. As presented in Table 6, they compose an anticipated annual range of costs applied to all municipal wastes sources; and the very substantial capital costs associated with the procedures are represented only by implied depreciation. Because enrichment is a significant source of pollution, reductions in phosphorus would seem to have a definite benefit if they can be effective in causing concentration to drop below thresholds required to create nuisance growths. It is generally agreed, however, that more

efficient and less costly treatment practices will be required before nutrient removal becomes generally accepted.

Industrial waste treatment costs, derived from The Cost of Clean Water, refer to expenditures required to achieve the equivalent of secondary treatment of industrial wastes. Because the major manufacturing activities of the Pacific Northwest--forest products and food processing--are characterized by large point discharges of organic wastes, many of the pollution problems of the area derive in some measure from manufacturing. Increased industrial waste treatment, then, would be expected to have an immediately improving impact on regional water quality. The main burden of financing the improved degree of treatment would fall upon the older pulp and paper plants of the area, plants which are in many cases directly responsible for pollution.

Nutrient removal from industrial wastes is priced on the assumption that the relationship between secondary treatment costs and phosphorus removal costs would be analogous to those applying for sanitary sewage. The level of expenditures, then, must be considered to be a very crude guess. Necessity for nutrient removal for many types of industrial wastes remains to be determined, as do procedures and attendant costs. Lacking precise knowledge of the stoichiometric balance of various industrial wastes and of methods of removing phosphorus, we can nevertheless state that there is a meaningful reduction in enrichment possible through treatment of industrial wastes simply because one source--a pair of phosphate processing plants near Pocatello, Idaho--accounts for a very large share of the total phosphorus in surface waters of the Columbia River Basin.

Effective erosion control--which is evaluated at the level of current annual expenditures estimated by the Soil Conservation Service to be necessary--would result in a major improvement in turbidity and sedimentation through much of the Pacific Northwest, particularly in the area east of the Cascades. Marginal improvements in bacterial quality, pesticide concentrations, and BOD levels could also be anticipated, since soils transport of such pollutants is common in agricultural areas.

Animal wastes control costs are assessed within a range of per-animal costs factors experimentally related to feedlot controls. There is little question that animal herds are the prime source of excessive bacterial concentrations in many parts of the Pacific Northwest. But effectiveness of control procedures is, to this time, very limited; so that impacts of expenditures may be expected to be light.

Revision of reservoir management procedures to provide dependable base flows would provide the most immediately favorable impact on water quality of any of the listed controls. Because of the high degree of regulation of Pacific Northwest streams, opportunities for revision are great. And because holdover storage is still rare, water so used could in most cases be applied without incurring offsetting costs. (The major cost would be a higher degree of uncertainty as to flows available for hydropower and irrigation; but application of hydrologic knowledge and statistical theory could reduce the degree of uncertainty to an acceptable level of risk.) The major obstacles to applying this remedy to the water quality problems of the area has been inability of the Corps of Engineers, Bureau of Reclamation, and private power companies to change accepted ways of

operating. Recently, however, the Corps of Engineers and private power in the Willamette River Basin have cooperated with the State of Oregon to manage flows for water quality during threatening periods. The Bureau of Reclamation's slower performance, like the reluctance of FWPCA to press for modification of reservoir operating rules, appear to residents of the area to be due in large part to the Department of the Interior's lack of a clear policy with respect to multiple purpose water management. The authorizing legislation for Federal reservoirs, too, limits willingness to alter operating rules for structures that antedate the statutory authorization of water quality benefits.

VI. Institutional Framework

1. State Programs

The Pacific Northwest has a long history of management of water resources for social purposes. Water rights laws antedate Statehood in every State. Cooperative irrigation development began over a century ago. Oregon's State water pollution control agency was among the first in the Nation. Multipurpose Federal water projects on the Columbia were initiated concurrently with TVA, and have continuously exceeded TVA in scale, if not in public attention. While eastern and southern States were ruthlessly savaging their water resources, cooperative fishery, watershed, and soil conservaton activities were underway in the Northwest in the nineteen-twenties and early nineteen-thirties.

It is not surprising, then, that the Northwest States have well established institutions for dealing with water pollution. Indeed, what is surprising is that the operations of those institutions in the last two decades have not more effectively forestalled pollution.

A review of the institutional facilities available to each of the States of the Pacific Northwest suggests a broad range of capabilities to deal with problems of water pollution. Oregon and Washington possess large technical staffs, a number of assistance and enforcement tools, and an operating format required to attack problems. Less populated and less wealthy, Montana and Idaho have much slimmer resources to bring to bear. (This is not to suggest

TABLE 8

INSTITUTIONAL CHARACTERISTICS

	Washington	Oregon	Idaho	Montana
Approved interstate W.Q. standards	X	X	X	X
Intrastate W.Q. strds.		X		
Stream classification	X			X
Independent pollution control agency	X	X		
Staffing: 1–10			X	X
11–20	X	X		
21–40				
State financial assistance	X	X		
State technical assistance	X	X	X	X
Permit system	X	X		X
Operator certification	X	X		X
Operator training	X	X		
Stream monitoring program	X	X		

that they have been relatively ineffective. Indeed, by reason of great personal talents and energies available, Idaho has had one of the most effective water pollution control programs in the Nation over the past five or six years).

The excellence of the institutional framework is demonstrated by the fact that all four Pacific Northwest States have had their water quality standards submissions approved--though the State of Washington's temperature standards for the Columbia River conflict with those of Oregon and Idaho.

The trend in the area seems to lie in the direction of application of discharge permits, State financial assistance for treatment plant construction, use-based water quality standards for all waters, and a minimum requirement of secondary treatment and disinfection for all municipal wastes. It should be noted, too, that separation of storm and sanitary sewers is uniformly required for new construction in all four States.

2. Institutional Barriers to Pollution Control

Pollution control programs run into distinct barriers of law, custom, or power balance that are common through the region. Of these, the most basic is the structure of western water law. The foundation of water rights in the west is the general right to divert and use water, subject only to priority. It is impossible, then, to structure water quality programs on any firm base flows. Where there is scarcity, water assumes a great speculative value which can only be maintained by diversion and use; thus there is a distinct incentive to over use water. Unfortunately, the access to water use has traditionally occured only in the withdrawal context; so that there is no precedent for protection of right to in-stream use of flows. (The notable exception to this is free public access to coastal beaches and coastal waters).

Less defined, but equally damaging to water quality efforts, has been a lack of firmly established definitions of pollution and of sanctions against polluters. All four States have penalties to apply in instances of pollution. But laws are so broadly drawn that responsibility is impossible to fix; and instances of legal action are rare. The lack of a firm enforcement base is most evident in connection with industrial polluters. Oregon has recently initiated a strong permit system that will, in the future, give great power to control industrial waste discharges; and Washington, with a long-established permit system, has had some success in securing adherence to administrative requirements. But even Washington has been unwilling to press a case of disputed waste discharge permit application

through the courts. Idaho and Montana have at times had great success in making cooperative arrangements with manufacturing establishments, depending on persuasiveness and the personality of able administrators to secure what law could not afford. In all four States, the lack of administrable legal sanctions has resulted in a situation in which the cause of pollution control advances by fits and starts, moving from plateau to plateau with the intermittent appearance of an interested, activist governor.

In recent years conservationists have noted a third, and intangible, barrier to effective pollution control. As waste treatment has advanced in prevalence, there have been only isolated instances of improvement in water quality; yet pollution control programs have not adjusted to deal with the many non-point sources of pollution. A sort of "sanitary engineering syndrome"--possibly fostered by the limited scope of FWPCA policy--has characterized pollution control agencies, who have not generally accepted the larger role of management of the quality of the aquatic environment that is being thrust upon them by the passage of time.

3. Enforcement Actions

There have been three Federal enforcement conferences held in the Pacific Northwest. While degree of success has not been uniform--due largely to the difference in the circumstances of the three actions--enforcement has unquestionably been the most effective element of FWPCA activities in the region.

1. The Lower Columbia Enforcement Conference has come into session several times--in 1958, 1959, and 1966--as the conditions of the lower Columbia have changed. Initially called to deal with high concentrations of coliform bacteria in the Portland, Oregon area, the action has since been broadened to deal with the problems of floating slime masses attributed to pulp and paper mill wastes. In a series of resolutions which have progressively been implemented, the Conferees have obtained general disinfection of municipal wastes, primary treatment of pulp and paper mill wastes, discontinuance of pulping operations at two paper plants, and installation of a process change by a pulp mill which will enable it to discontinue barging spent pulping liquors from the Willamette to the Columbia River.

2. The Puget Sound Enforcement Conference has resulted in documentation of biological damages inherent in waste disposal practices of pulp and paper manufacturers, and recommendations for the installation of treatment facilities and deep water diffusers by eight pulp and paper mills. Agreement has been reached with four of the mills

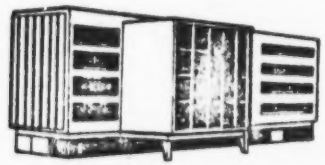
to undertake recommended actions to protect the quality of the waters of Puget Sound. The action is in its sixth year, and has involved great controversy; but an ultimate resolution of a problem of three decades standing appears to be in sight.

3. The Lower Snake Enforcement Conference has met on only one occassion, resulted in no agreement among the conferees, and did not develop specific recommendations. The conference may well have been premature, in that it pivoted on problems that might occur with dam construction on the Lower Snake River. On the other hand, it did bring to a variety of attentions the actual and potential water quality problems of the area, resulted in a State order to several waste sources to provide treatment, and may prove to have been instrumental in averting the worst consequences of oxygen depletion and increased temperature that may eventuate in connection with the structure.

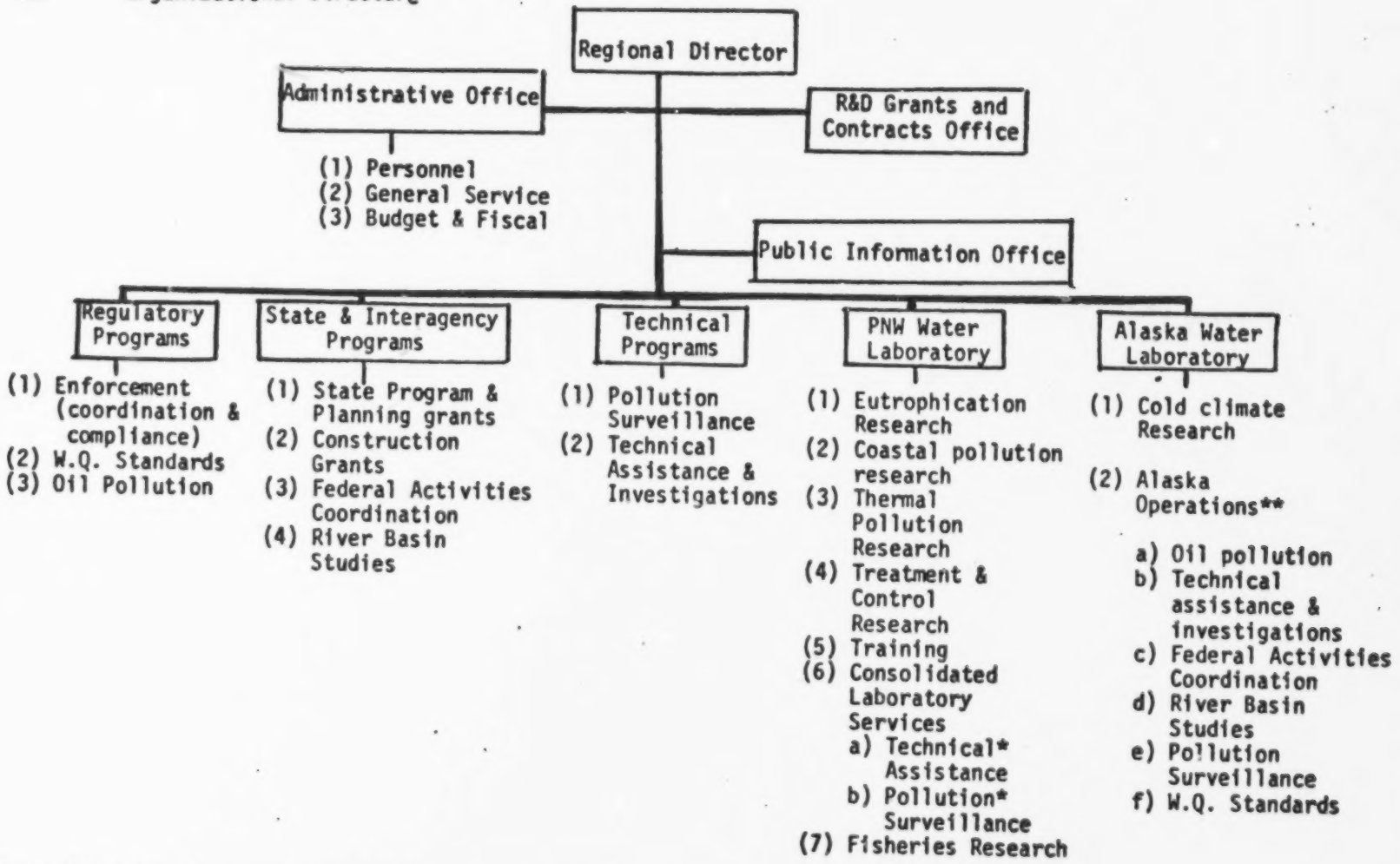
SUMMARY OF FWPCA PROJECTS AND RESOURCES

NORTHWEST REGION

NORTHWEST REGIONAL BUDGET
FY-1968

BUDGET	MANPOWER	 FACILITIES
$3,318,000	CEILING: 219 ON-BOARD 198 5/31/68	**OREGON:** PORTLAND: OFFICE-LAB 12,500 SQ.FT. CORVALLIS: OFFICE-LAB 50,000 SQ.FT. NEWPORT: LAB 450 SQ.FT **ALASKA:** COLLEGE: OFFICE-LAB 26,000 SQ.FT. ANCHORAGE: OFFICE 400 SQ.FT.

II. Organizational Structure



* Technical and program direction from Technical Programs
** Technical and program direction from Regional program director

III. Key Projects

A. Water Quality Standards Programs

1. Secure standards for Alaska.

2. Resolve inconsistencies of temperature standards for the Columbia River.

3. Deal with the exemption for placer mining activities contained in Alaska statutes.

4. Obtain anti-degradation clauses.

a. Montana and Alaska: great opposition to concept exists.

b. Oregon and Idaho: debatable authority for the concept in language of State law.

c. Washington: Substance, but not the precise statement, is found in current standards.

B. Basin Planning Programs

1. Water Resource Project Studies.

a. Requested, 1961-68: 66

b. Completed, 1961-68: 53 (6 in 1968)

c. Requiring re-evaluation in light of new reimbursement policy: 15

d. Completed studies recommending storage for water quality control: 32 (W.Q. storage authorized: 1 project, 16,000 AF).

2. Interagency Studies of Pacific Northwest River Basin Commission (Water Resource Council Type I and Type II Studies.)

a. Columbia North Pacific (Type I)

i) Municipal and industrial water supply and water pollution control appendices (12 sub-basins) completed for present status, under preparation with respect to future needs and means to satisfy needs.

ii) Participation in plan formulation and evaluation to be satisfied in future.

b. Puget Sound (Type II)

i) Pollution control appendices nearing completion for the 11 sub-basins; water supply data collected and draft written, future participation will include only review.

ii) Plan formulation and evaluation requirements to be satisfied in future.

c. Willamette Basin (Type II) appendices completed, plan formulation continuing for both water supply and pollution control.

3. Comprehensive projects

a. Immediate needs reports completed for all waters of the region.

b. Comprehensive reports to be completed by 12/31/1968.

i) Willamette Basin: in print.

ii) Snake basin: in final draft.

iii) Upper Columbia and Oregon Coast Basin: in first draft.

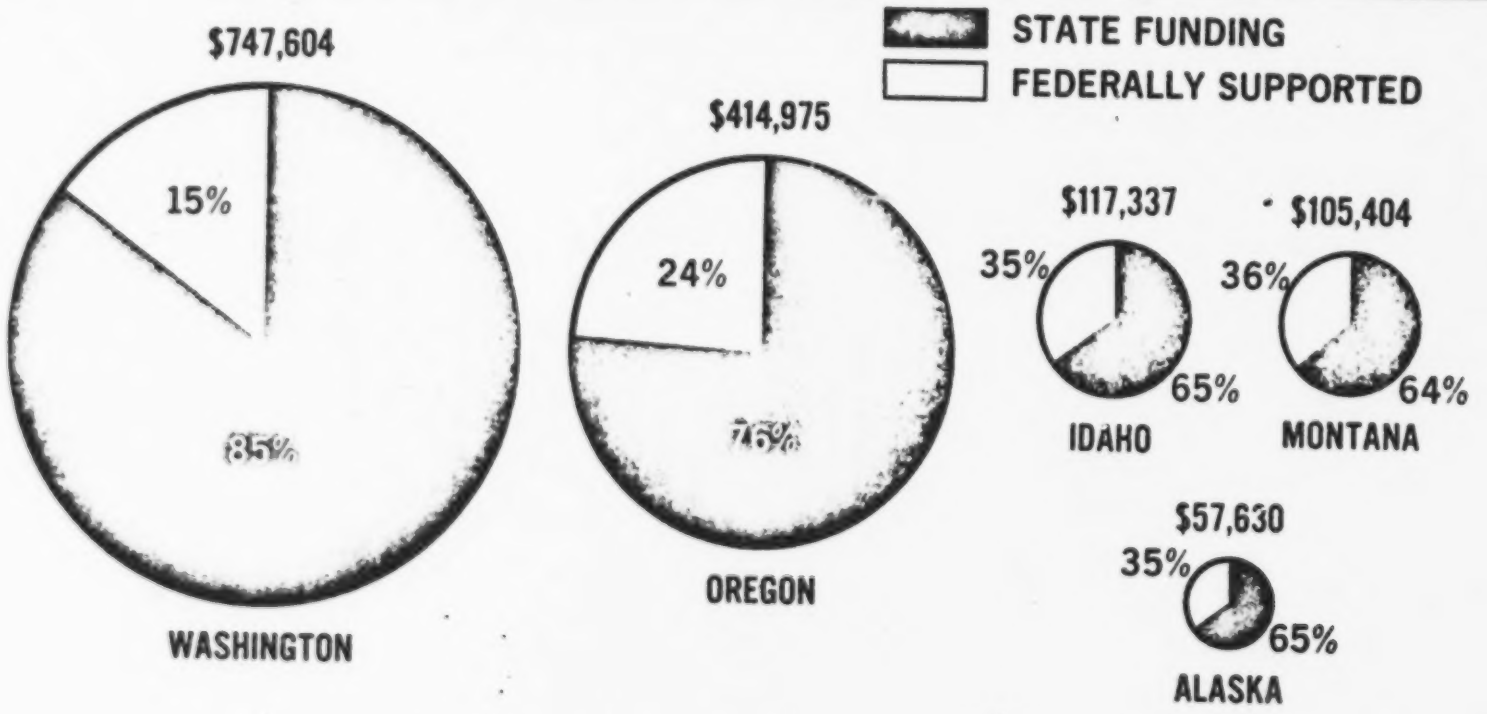
iv) Lower Columbia Basin: study underway.

v) Puget Sound Basins: to be a summary of the Type II interagency study appredices.

c. Power Plant Siting Study is to be initiated in near future.

d. Power Rate Impact Study outline being formulated.

STATE PROGRAM GRANTS FY 1968
NORTHWEST REGION



4. State Program and Planning Grants.

a. State Program Grant, Fiscal year 1968.

State	Grant award	State funds	Total State Program Funding
Alaska	$ 19,760	$ 37,870	$ 57,630
Montana	38,514	66,890	105,404
Idaho	41,337	76,000	117,337
Oregon	90,700	324,275	414,975
Washington	123,104	634,500	747,604

b. State planning grant applications being solicited.

C. Technical Projects

1. Columbia River thermal effects study.

a. Biological effects study ($300,000) to be initiated in fiscal 1969.

b. Mathematical temperature prediction model ($300,000) underway.

i) River run model complete

ii) Deep reservoir and estuary models underway.

iii) Thermal monitoring to be initiated.

2. National Estuariane Pollution Control Study begun.

3. Recreational sites waste treatment study proposed.

4. Plywood glue waste study essentially completed.

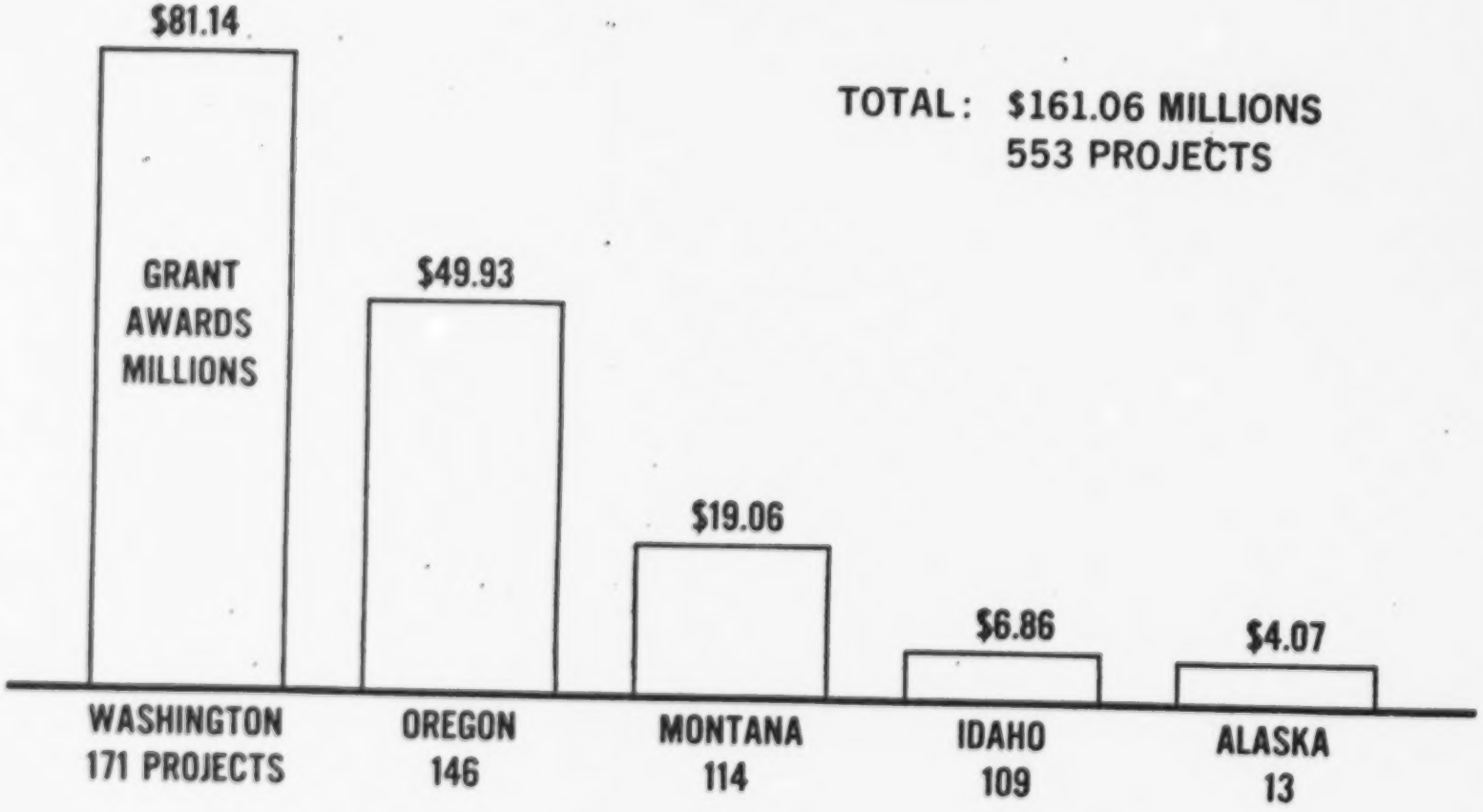
5. Liquid Waste Disposal in Lava Terrain of Eastern Oregon Study completed.

6. Aerated lagoon treatment of food processing waste study completed, consultations continuing.

7. Study of underground disposal of radioactive wastes has not been initiated because of AEC's unwillingness to concur.

8. Effects of dredging on water quality study and handbook being prepared.

CONSTRUCTION GRANTS AWARDED
1956-1968 (TO DATE)



TOTAL: $161.06 MILLIONS
553 PROJECTS

9. Houseboat wastes study completed.

10. Alaska placer mining study to be initiated in Fiscal 1969.

11. Cook inlet oil pollution surveillance constitutes a continuing activity.

12. Kodiak Harbor surveys are completed, report not forthcoming.

13. Silver Bay water quality survey is underway.

D. Federal Facilities Coordination

1. Plant inspection and plan review are continuing activities.

2. Program reviews are forestalled by lack of cooperation from other Federal agencies. The Forest Service engaged in cooperative review in fiscal 1967, no reviews in 1968.

3. Review and Comment on Corps of Engineer dredging operations is a continuing activity.

E. Enforcement

1. Puget Sound Conference negotiations and administration continue during adjournment.

2. Lower Columbia River Conference negotiations and administration continue during adjournment.

3. Oil pollution control monitoring is a continuing activity--45 documented violations in fiscal 1968 produced 8 fines.

F. Construction grants administration: grants awarded to date, 1956-68

G. Pollution Surveillance

1. Administration of State/Federal water quality surveillance programs is a continuing activity.

2. Compilation of waste inventories occurs as directed.

H. Research and Development

1. Eutrophication Research (19 persons).

   a. Lake Salie (Ely, Minnesota).

   b. Upper Klamath Lake (Klamath Falls, Oregon).

   c. Moses Lake (Washington).

2. Treatment and control of Industrial Wastes (7 persons).

   a. Paper and related products.

   b. Food and related products.

   c. Biological effects of industrial wastes (inactive).

3. Coastal pollution control (2 persons).

4. Cold climate pollution control (17 persons, 5/6 projects).

5. National thermal pollution research.

6. Training (fiscal 1968: 6 courses 171 trainees).

7. R&D Grants Management (fiscal 1968: 3/4 grants awarded per month, 57 active grants and 1 contract at year end).

IV. Regional Problems of FWPCA

A. Rejection of the "no degradation" policy, as manifested at the Western Governors Conference

1. Alaska and Montana: broad opposition, on basis of impeded industrial development--in case of Alaskan placer mining, policy conflicts with State law.

2. Idaho and Oregon: policy is viewed as inappropriate to use/quality criteria embodied in approved standards, as interference with State's prerogatives, and unauthorized by State law.

3. Washington: policy is embodied in standards, but somewhat different terms of expression.

B. Lack of clear Department of the Interior policy of water management for quality control.

1. Bureau of Reclamation is viewed regionally as allied with irrigation in opposition to pollution control.

2. New reimbursement policy for storage for quality control is considered ambiguous in application; State and conservation groups consider it tactic of Bureau of Reclamation to harrass Corps of Engineers activities.

3. Reallocation of benefits to include water quality control in older reservoirs has been recommended by inter-agency Willamette Basin task force, probable future recommendations will come from on-going Type I and Type II studies.

C. Puget Sound pulp and paper companies refusal in four instances to comply with recommendations of the enforcement conference.

D. Opposition to thermal pollution control

1. Private power companies desire to retain control over site-selection without accepting engineering controls.

2. Federal agencies - BPA and AEC - have allied themselves with private power, using a regional development rationale.

3. Water temperature standards approved for Washington are considerably more lax--and conflict with--those of Idaho and Oregon.

E. Administrative Problems.

1. Communications and operational coordination for Alaska.

2. Loss of expected assistance from Air Force in cold climate research.

3. Lack of staffing for study on environmental consideration for thermal power plant siting.

4. Headquarters lack of clear policy line and its arbitrary editorial standards which have caused comprehensive studies to require up to two years review and six drafts without substantive change.

5. Lack of responsiveness, delays in availibility, of STORET and other computer services.

MANPOWER RESOURCE PROFILE (4/1/67)

	Portland R.O.		Corvallis Lab.		Alaska Lab.		Total	
	Number	%	Number	%	Number	%	Number	%
Administration	15	19.2	4	4.1	3	6.9	22	10.1
Social Science	1	1.2	1	1.0	1	2.3	3	1.3
Sanitary Engineers	17	21.7	16	16.6	4	9.3	37	17.0
Other Engineers	3	3.8	1	1.0	3	6.9	7	3.2
Biologists	4	5.1	14	14.5	5	11.6	23	10.5
Chemists	4	5.1	9	9.3	4	9.3	17	7.8
Other Professional	4	5.1	7	7.2	1	2.3	12	5.5
(Total Professional)	(48)	(61.5)	(52)	(54.1)	(21)	(48.8)	(121)	(55.7)
Aides & Technicians	6	7.6	8	8.3	1	2.3	15	6.9
Clerical	17	21.7	21	21.8	4	9.3	42	19.3
Service	1	1.2	0	–	2	4.6	3	1.3
Part Time & Students	6	7.6	15	15.6	15	34.8	36	16.5
Total Clerical & Others)	(30)	(38.5)	(44)	(45.9)	(22)	(51.2)	(96)	(44.3)
TOTAL	78	35.9	96	44.2	43	19.9	217	100.0
1968 Ceiling	89		92		38		219	
On-board, 5/31/68	81		87		30		198	